University Grants Commission
NET Bureau

UGC – NET Syllabus

Subject: Forestry **Code:106**

Total Units: 10

UNIT I: GENERAL FORESTRY

UNIT II: SILVICULTURE

UNIT III: AGROFORESTRY AND SOCIAL FORESTRY

UNIT IV: FOREST PRODUCTS AND UTILIZATION

UNIT V: FOREST BIOLOGY AND TREE IMPROVEMENT

UNIT VI: FOREST RESOURCE MANAGEMENT

UNIT VII: CLIMATE CHANGE AND ENVIRONMENTAL CONSERVATION

UNIT VIII: REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM

UNIT IX: FOREST POLICIES, LEGISLATIONS AND CONVENTIONS

UNIT X: RESEARCH METHODOLOGIES AND STATISTICAL APPLICATIONS

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Unit I: General Forestry

History of Forestry, Definition and purpose, Types of forestry, Global forestry resources, World Forest types and their major associate species, Forest types of India and States - Distribution and types, Status of forests - Country & State wise area and extent as per recent FSI Report, Ecosystems, Ecosystem services from Forestry systems, Forests and livelihoods, Reasons for decline in Forest Cover, Major threats to forests - deforestation - Indian and global scenarios, Biological invasion, Forestry and Industries, Role of Forestry in Resource and environmental conservation.

Unit II: Silviculture

2.1. Silviculture - Principles and Practices

Silviculture - Site factors, Forest regeneration and ecology of regeneration, Soil seed bank, Silvicultural systems-high forests and coppice forests, Tree seeds and nursery technologies - Choice of species, Planting techniques, Tending operations, Silviculture techniques, Forest stand development and dynamics, Stand density determination, Competition and density effects, Crown competition factor, Silvicultural practices for Short Rotation Forestry, Coppice forestry, Quantifying site quality - Site index with Examples.

2.2. Silviculture of Economic Trees

Silviculture of important tree species; *Populus* spp. (Poplar), *Eucalyptus* spp. (Eucalyptus, Safeda), *Dalbergia sissoo* (Shisham), *Acacia catechu* (Amaltas/Golden Shower), *Tectona grandis* (Teak, Sagaun), *Shorea robusta* (Sal), *Casuarina equisetifolia* (She – oak), *C. junghuhniana* (She – oak), *Pinus roxburghii* (Chir – pine), *Gmelina arborea* (White Teak/Gamhar/ Kashmir tree), *Azadirachta indica* (Neem), *Albizia lebbeck* (Siris), *Diospyros melanoxylon* (Tendu/Kendu), *Terminalia* spp. (Tropical Almond/Indian Almond/*Sea almond*), *Pterocarpus santalinus* (Red Sanders/Red Sandalwood), *Pterocarpus marsupium* (Indian Kino Tree/Malabar Kino/Vijaysar), *Santalum album* (Indian Sandal Wood/Chandan), *Quercus leucotrichophora* (Banj Oak/Himalayan Oak), *Dipterocarpus indicus* (Dhuma/Guga/Kalpayin/Karanjili), *Chukrasia tabularis* (Indian Mahogany), *Melia dubia* (Malabar Neem), *Toona ciliata* (Toon/Red Cedar), *Bamboos* (Bans/Bamboo) *and Rattans* (Rattan/Rattan Palm), *Swietenia macrophylla* (Big Leaf Mahogany/Honduras Mahogany), *Salix* spp. (Willows), *Cedrus deodara* (Deodar/Himalayan Cedar), *Abies pindrow* (Raga/Silver Fir/West Himalayan Fir) and *Picea smithiana* (Rai/Morinda Spruce/Himalayan Spruce/Spruce).

2.3. Plantation Forestry

Plantation forestry – Global and Indian scenarios, Indigenous techniques for plantations- Taungya, Shifting Cultivation, Community Forests, Plantation establishment and management technique, Pitting techniques, Energy plantations and industrial plantations, Afforestation in wastelands and inhospitable sites, High density and short rotation (HDSR), Density management, Production and Productivity in plantations, Precision silviculture, Mechanization of silvicultural practices, Forest Development Corporation, Certification of Industrial Plantations, Carbon projects on tree plantation.

Unit III: Agroforestry and Social Forestry

3.1. Agroforestry and Tree-crop Interaction

Agroforestry - Benefits and limitations, Classification of agroforestry systems - Structural, functional, socio-economic and ecological, Agroforestry system and practices in different agro-ecological zones, Diagnosis and design of agroforestry system, Land capability classification and land use, Preference of species for agroforestry, Tree-crop-animal interactions- Nature, Types of interactions- positive and negative, Above and belowground dynamics, Biomass allocation patterns, Management options to neutralize negative interactions, Social forestry, Farm forestry, Recreation forestry, Linear strip plantations, Community forestry, Urban forestry and Arboriculture, Sub-Mission on agroforestry - Green India Mission and Bamboo Mission, International and National Organizations in agroforestry research and development.

3.2. Industrial Agroforestry

Industrial agroforestry – Supply chain and marketing system, Market intelligence for agroforestry products and Agroforestry value chain models, Contract tree farming system in India, Consortium approach, Tree insurance scheme in agroforestry, Multifunctional agroforestry system, Ecosystem services and environmental benefits.

3.3. Trees Outside Forests

Trees Outside Forests (TOF) – Classification-based on Land use, Methodology of Assessment by Forest Survey of India (FSI), Status of TOF in India - State wise TOF status and opportunities, demand and supply pattern of wood and non-wood requirements, Government policies to promote TOF, National Forest Policy, National Agroforestry Policy (2014). TOF Certification Schemes, International certification

agencies, Certification Institution and organization – Forest Stewardship Council Certification (FSC), Programme for the Endorsement of Forest Certification (PEFC), Sustainable forestry Initiative (SFI), Indian Forest and Wood Certification Council (IFWCC), National Cooperative Consumers' Federation (NCCF) of India, Ltd.

3.4. Modern Nursery Technologies: Introduction and importance of nursery, Types of nurseries-temporary and permanent, bare root, containerized and clonal nursery, Bare root nursery- nursery soil and water management, bed preparation, pre-sowing seed treatments, seed sowing and intermediate operations - pricking, watering, fertilization, weeding and hoeing, Environmental factors affecting seedling growth, Root culturing techniques, Containerized nursery—type and size of containers including root trainers, selection of growing medium, Types of green house and mist chamber for propagation, Vegetative propagation – importance, selection of superior genotypes, Advanced methods of propagation, containers, growing media, fertilizers, sanitation and management in vegetative propagation. Special requirement for clonal propagation, Propagation structures and management, Clonal propagation- mini-clonal and micro cuttings technologies, Vegetative propagation of Bamboos and Rattans, Factors affecting rooting of cutting, Pests and diseases management, Seedling quality assessment, grading, packaging, storing and transportation.

3.5. Financial Analysis and Economic Evaluation

Financial analysis and economic evaluation - Cost benefit analysis and land equivalent ratio, Entrepreneurship development, Trade, Monetization of intangible services from forests, Contribution of goods and services from forests to national GDP and natural resource accounting.

Unit IV: Forest Products and Utilization

4.1. Timber, Engineered Wood and Value addition

Timber – Physical, mechanical, anatomical, chemical, electrical, acoustic and thermal properties of wood, Standard tests of timber, Mechanics and rheology of wood, Grading of timber (Teak, Rosewood, Sal, Redsanders and Sandal), Wood conversion - Wood working machineries, types of conversion, Wood seasoning and preservation, Modified wood – Utility and prospects, Wood physics and Chemistry, Pulp and paper technology, Composite wood, Types of wood, Adhesives and polymers, Biomass gasification and saccharification, Nanotechnology in wood and wood products, Value addition techniques – Briquettes, Biochar, Activated carbon- Applications.

4.2. Non-Timber Forest Products

Non-Timber Forest Products (NTFPs) – Classification, distribution, sustainable harvesting, processing, value addition and marketing of Gums, Resins, Katha and Cutch, Fibres and Flosses, Dyes, Tannin, Essentials oils, Tree Borne Oil Seeds (TBOS), Raw drugs, Bamboos, Rattans and other NTFPs, Indigenous knowledge and traditional practices, Role of Co-operative Societies in Non Wood Forest Products (NWFPs).

4.3. Medicinal and Aromatic Plants

Diversity, Distribution, Indigenous knowledge and traditional practices, Agro-techniques, Importance in human health, national economy and related industries, Concept of organic farming, Good Agricultural and Collection Practices (GACP) and Good Agricultural Practices (GAP) in production, Quality concern in plant based drugs, Climate and soil requirements, Cultural practices, Post harvesting processes and yield, Important constituents – *Glycyrrhiza glabra* (Mulethi), *Senna* sp. (Senna), *Gloriosa superba* (Kalihari), *Valeriana* spp. (Jatamansi), *Swertia chirayita* (Chiraita), *Plantago* spp. (Isafgoal), *Rauwolfia*

serpentina (Sarpgandha)*, Withania sominifera* (Ashwagandha)*, Papaver* sp. (Aphim)*, Aloe vera* (Ghritkumari)*, Asparagus* spp. (Satavari)*, Stevia rebaudiana* (Madhur Patta)*, Chlorophytum tuberosum* (Safed Mushali), *Andrographis paniculata* (Kalmegh)*,* aromatic plants – *Cymbopogon* spp. (Lemon Grass), *Mentha* spp. (Pudina), *Ocimum* spp. (Tulsi), *Rosa* spp. (Rose), *Tagetes minuta* (Wild Marigold), *Lavandula* spp. (Lavander), *Rosemarinus* sp. (Rosemary), *Pogostemon* spp. (Patchouli) and *Geranium* spp. (Geranium), Breeding and Hybridization techniques, Intellectual Property Rights (IPR).

Unit V: Forest Biology and Tree Improvement

5.1. Forest Biology

Reproductive Biology, Flower types, Pollination - Self and cross pollination, Sex expression, Monoecious, dioecious and their evolution, Floral biology and characteristics, Fertilization, Dispersal and gene flow, Forest genetic resource and diversity - In - situ and ex - situ conservation, On farm conservation, Handling and storage of Forest Genetic Resources (FGR), Quarantine laws, FGR exchange, Protection of Plant Varieties and Farmer's Rights Act (PPVFRA) for Tree Varietal Registration.

5.2. Tree Improvement and Breeding Methods

Genetic constitution of trees – General concepts of forest genetics, Variations, Nature and extent of variations, Causes and types of variations, Tree improvement, Concept of seed source/Provenance/Progeny/Clone, Breeding methods, Selection, Hybridization, Mutation, Migration, Mating designs, Genetic testing, Gene and Environmental Interactions, Seed Production Areas and Seed Orchards.

5.3. Forest Biotechnology

Clonal technology – Prospects and problems, Macro propagation in trees, Cloning techniques, Protocols for micro propagation, Micro

propagation of juvenile material and mature trees, Cryopreservation, Somaclonal variations, Anther and pollen cultures, National certification and management of Plants – Quality Planting Material (QPM) through Tissue Culture, Meristem culture, Embryo culture, Protoplast culture and cybrids, Genetic engineering, Molecular markers and applications.

Unit VI: Forest Resource Management

6.1. Biodiversity Conservation and Wildlife Management

Forest ecology - Population ecology, Community ecology, Ecological indices, Community dynamics - composition, structure and function, Forest biomass and productivity, Nutrient cycling, Ecology of forest landscapes, Spatial heterogeneity, Ecological succession, Ecosystems – Food chain and food web, conservation (in – situ) of biodiversity (Hotspots, Wildlife Sanctuaries, National Parks, Biosphere Reserves, Tiger Reserves) and ex - situ conservation.

Wildlife Biology – Definition and objectives, Population dynamics, Wildlife Habitat Assessment, Management of protected areas (In-situ conservation) - National Parks, Sanctuaries, Tiger Reserves, Community reserves, Conservation reserves, Zoning and buffering, Wildlife census - Direct and indirect methods of Population Estimation, Special projects for wildlife conservation, Introduction and reintroduction of species, Wildlife corridors, Human Animal Coexistence, International conventions – Man and Biosphere Program (MAB), Convention on International Trade in Endangered Species (CITES), Convention on Migratory Species (CMS) and Convention on Biological Diversity (CBD), International Union for Nature Conservation (IUCN).

6.2. Forest Biometry

Forest biometry – Measurements of tree parameters, Volume of felled/standing trees, Volume tables - Biomass estimation, Growth and increment, Growth functions - Growth cycle and phases, Predicting growth and yield, Yield tables - Stand growth and yield equations, Stand tables, Simulation models, Evaluation, calibration, verification and validation of forest growth and yield prediction.

6.3. Forest Soils and Watershed Management

Forest Soils – Classification, Properties, Nutrient cycles and dynamics, Management of problem soils, Soil and water conservation, Soil productivity, Land use planning - Concepts and techniques, Watershed management - Characteristics, Planning, Execution, Community participation and evaluation, Water harvesting and its efficient use, Preparation techniques for micro-plan of watershed.

6.4. Ecosystem Services

Ecosystem services – Regulating, supporting, cultural and provisioning services, Quantification of ecosystem services - Direct and indirect methods, Payment for ecosystem services, Participatory approaches - Planning, Implementation, Monitoring and Evaluation, Inter-governmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES) and Millennium Ecosystem Services Assessment (MEA).

6.5. Forest Protection and Management

Forest degradation – Causes and mitigation measures, Biological invasion, Forest fires –Types and causes, Status of forest fire in Global and Indian scenarios, Injuries and impacts on forest ecosystems, Fire detection and management.

Pest and Disease in forestry ecosystem - types of infection, Control measures- physical, chemical, biological, Breeding techniques for stress tolerance, Integrated Pest and Diseases Management- IPM and IDM.

Forest management – Growing stock, Rotation, Yield, Normal forests and sustainable yield regulation, Working plan, Joint Forest Management, Forest evaluation, Sustainable forest management – Criteria and indicators.

UNIT VII: CLIMATE CHANGE AND ENVIRONMENTAL CONSERVATION

Environmental degradation - Pollution, Environment Impact Assessment (EIA), Climate change, Impact of climate change on forests and ecosystem services, Causes of global climate change, Green - house gases- effects, consequences, Ozone depletion, Potential threats, Global carbon cycle and Carbon budget, Carbon sequestration, Forests and climate change- Forest responses and vulnerabilities to climate change, Adaptation and mitigation, India's international obligations, International Conventions - UNFCCC, IPCC, CoP- LULUCF, REDD and CDM, Indian initiatives- National Action Plan on Climate Change (NAPCC) and Panchamrit.

UNIT VIII: REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM

Remote sensing and its types, Geo-referencing, Resolution and its types- Spatial and spectral, Digital Image Processing, Image classification- Supervised and unsupervised, Vegetation Indices (Normalized Difference Vegetation Index), Geographic Information System (GIS), Components of GIS - Raster and Vector Data, Global

Positioning System (GPS), GAGAN, IRNSS, Segments of GPS, Applications of Remote Sensing and GIS in forestry and forest resource management, Forest cover, Land use and Land cover mapping.

UNIT IX - FOREST POLICIES, LEGISLATIONS AND CONVENTIONS

National Forest Policy, 1894, 1952 and 1988, Indian Forest Act, 1927, Forest (Conservation) Act, 1980, Wildlife (Protection) Act, 1972, Biological Diversity Act, 2002, Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, National Agroforestry Policy, 2014, International Conventions-UNFCCC, MAB, CITES, CMS, CBD, UNCCD, ITTA, RAMSAR and UNFF.

UNIT X: RESEARCH METHODOLOGIES AND STATISTICAL APPLICATIONS

Methods for the ecological assessment of forest vegetation, estimation of biomass and productivity, Assessment of faunal diversity, Statistical methods - Mean, median, mode and standard deviation, Correlations and regressions, Hypothesis testing, Parametric and Non - parametric tests, Experimental designs - Basic principles, Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD) and Split Plot Design (SPD), Principal Component Analysis - D^2 statistics- AMMI analysis.